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FIELD TESTS OF IMPORTED RED-CLOVER SEED

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CONTENTS

	Page
Introduction	1
Trials in 1922–1925	2
Relative yields, 1922–23	3
Relative yields, 1923–24	5
Relative yields, 1924–25	7
Conclusions from 1922–1925 tests	9
Trials in 1926–1929	10
The standard for domestic seed	10
Yields from French seed (except import lots)	11
Trials in 1926–1929—Continued.	
Yields from foreign, other than French, seed	13
Foreign compared with Ohio seed	16
Second cutting	17
Weed content	18
Yields from import lots	19
Winterkilling	23
Summary	23

INTRODUCTION

Although the quantity varies from year to year, more red-clover seed is imported into the United States than is exported. This foreign seed has come in the past from a number of sources, including France, Poland, Italy, Canada, Chile, England, and Germany, and finds its way as far west as Kansas and Iowa. During recent years the bulk of imported red-clover seed has come from France and Poland. Growers in practically all parts of the clover area, therefore, are concerned with the merits of this imported seed as compared with that domestically produced.

In 1922 the United States Department of Agriculture, in cooperation with a number of the State agricultural experiment stations,[1] began testing the value of this foreign seed for the clover region of the United States. Seed of known origin was distributed each year to cooperating State stations. In some cases only a few lots could be tested each year; in others, the stations were able to devote considerable areas to the work. Plots varied in size from triplicate one one-hundred-and-twentieth to duplicate one-tenth acre. In some cases, as at the Arlington Experiment Farm in 1925–26, it was necessary to discard the duplicate, and only one plot of a number was harvested. Usually two crops were cut and weighed, but in some cases only one cutting was taken. It is realized that the sources of error are many and that no single trial, whether the result is favorable or unfavorable to the foreign strains of red clover, can be considered dependable. The general trend, however, is unmistakable, and the record is offered in full confidence of its substantial correctness.

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[1] The assistance of the agricultural experiment stations of the States herein named is acknowledged with thanks.

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Reports were received on the yields in terms of tons or pounds of green matter, field-cured hay, or dry matter per acre. The method of reporting was not uniform, but a uniform manner of expressing results has been followed; all yields are compared with the average yield of all United States lots grown at a given station in a given year, to which is assigned the value 100. It is recognized that the method is not without objection from the standpoint of exact agronomic data, but it gives a picture on a uniform basis that could not be had by any other method. Whatever the conditions at any one station, and whatever the method of reporting yields, these conditions and methods were the same at any one station for any one year, and all lots were treated alike. Throughout this circular, therefore, unless specifically stated otherwise, the figures for the yields from seed from any source are relative to the average yield from all domestic lots for that year and station expressed as 100.

The 100 taken as the United States standard represents the average yield from all lots of domestic red clover grown at any station in any year, and is necessarily lower than the figure for the best lots. Some examples of this will be given later. All calculations have been made by the junior writer from the original data furnished by cooperating experiment stations.

In January, 1926, a mimeographed report[2] on the comparative yields up to and including the record of the crop of 1925 was issued. Since that time further trials have been made. The present report summarizes the results of the trials from 1922 to 1925 and reports in more detail the trials from 1926 to 1929, inclusive. During the latter period the work was carried on in the same manner as before.

For mechanical convenience the States from which the trials from 1922 to 1925 are reported have been arranged in three groups: (1) Those in which red clover appears to suffer most from winterkilling—Iowa, Minnesota, New York; (2) those in which neither winterkilling nor disease appears to be extreme—Wisconsin, Michigan, Ohio, Pennsylvania; and (3) those in which disease is a more important factor than cold—Maryland, Virginia, Tennessee. For the second series of trials, those made from 1926 to 1929, some change was made in the arrangement of the report. The Michigan and Wisconsin records were included in the first group; records from Indiana and West Virginia have been added to those of the second group; the Maryland record has been transferred from the third to the second group; and records from Kentucky and Missouri have been added to those of the third group.

TRIALS IN 1922–1925

The results of the trials from 1922 to 1925, inclusive, are shown in Tables 1 to 9. These data are taken from the 1926 report. Results with two or more lots of seed originating in one country have been averaged, and the file numbers in the 1926 report[3] have been omitted.

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[2] PIETERS, A. J., and HOLLOWELL, E. A. IMPORTED RED CLOVER SEED AND ITS VALUE IN THE UNITED STATES. U. S. Dept. Agr., Bur. Plant Indus. 23 p. January 13, 1926. [Mimeographed.]

[3] Anyone interested in the detailed figures may obtain a copy of the 1926 report on application.

RELATIVE YIELDS, 1922–23

Tables 1, 2, and 3 give the results of the trials at the experiment stations in the three groups of States for the crop year 1922–23.

TABLE 1.—*Relative yields from imported and domestic red-clover seed in Iowa, Minnesota, and New York, 1922–23*

Source of seed	Yields in tests in Iowa		Yields in tests in Minnesota, as percentage of average yield from all domestic seed	Yields in tests in New York, as percentage of yield from Michigan seed [2]
	Percentage of average yield from domestic seed	Percentage of average yield from Iowa seed [1]		
Imported:				
Central Europe	81.5	78.5	100.5	73
Chile	65.5	62.5	(3)	38
Czechoslovakia (Bohemia)	55	53	116.3	90
England	41	39	(3)	----------
France	46.2	44.6	(3)	60.7
Hungary	58	55	98	45
Italy	37.3	35.7	(3)	2.5
Poland	----------	----------	68	----------
Domestic:				
Idaho	148	142	110	90
Michigan	----------	----------	94	----------
Minnesota	----------	----------	105	----------
Ohio	129	124	112	----------
Oregon [4]	28	27	81	----------
Tennessee	95	91	98	90
Wisconsin	----------	----------	99	----------

[1] 9 checks.
[2] 6 nearest checks.
[3] Winterkilled; not harvested.
[4] Grown in western Oregon. Some red-clover seed is produced in eastern Oregon, but has not been tested.

Two cuttings were taken at the stations in the first group of States in 1923. In Minnesota the plots seeded to Chilean, English, French, and Italian seed were not harvested. These clovers were winterkilled almost completely, while the clover on the plots seeded to Michigan, Ohio, Idaho, and Minnesota seed winterkilled about 10 to 11 per cent; that from Wisconsin seed, 6 per cent; and that from Tennessee anthracnose-resistant seed, 18 per cent. The 100 taken as the standard represents the average yield in 1923, at each station, from those domestic plots shown in the table under each station; except that for New York the average yield from the Michigan checks has been placed at 100.

Results similar to those reported in Table 1 are given in Table 2 for the States of the second group.

TABLE 2.—*Relative yields from imported and domestic red-clover seed in Michigan, Ohio, Pennsylvania, and Wisconsin, 1922–23* [1]

Source of seed	Yields in tests in Michigan (East Lansing)		Yields in tests in Ohio (North Ridgeville), as percentage of average yield from domestic seed	Yields in tests in Pennsylvania, as percentage of average yield from domestic seed	Yields from tests in Wisconsin, as percentage of average yield from domestic seed		
	Percentage of average yield from domestic seed	Percentage of average yield from Michigan seed			Ashland	Spooner	Marshfield
Imported:							
Central Europe	103.5	87.5	107.5	103	112.5	95	97
Chile	113.8	96	90	118.3	136.5	83.8	101.5
Czechoslovakia (Bohemia)	84.5	71	82	105	115.6	89.3	91
England	82	69	78	----------	103	82	100
France	96.6	81.2	108.4	115.8	104.8	88	94
Hungary	103	87	90	124	128	95	88
Italy	69.3	58.3	78.3	98	62.3	74	100
Poland	----------	----------	88	----------	130	109	94
Domestic:							
Idaho	90	76	109	103	76	109	----------
Minnesota	101	85	----------	----------	----------	----------	----------
Ohio	110	93	107	99	111	105	88
Oregon	99	83	113	----------	95	82	100
Tennessee	98	83	83	93	94	95	106
Wisconsin	102	86	88	104	112.5	102.5	100

[1] In Michigan and Pennsylvania 2 cuttings were made; in Ohio and Wisconsin, 1. The 100 taken as a standard represents the average yield from the domestic lots shown in each column.

While in the first group in only two cases foreign seed yielded as well as the domestic seed or better, there are in the second group several cases in which the record of the seeds of foreign origins is excellent. This is especially true of the record from Ashland, Wis., where the heavy snowfall affords winter protection and the foreign clovers are able to show the producing capacity they undoubtedly possess wherever they can survive winter cold or disease attack. The record from Spooner, Wis., shows that where winter conditions are more severe the foreign clovers do not yield so well as the domestic.

In the third group of States, reports were obtained from the agricultural experiment stations in Maryland, Virginia, and Tennessee. (Table 3.)

TABLE 3.—*Relative yields from imported and domestic red-clover seed in Maryland, Tennessee, and Virginia, 1922–23*

Source of seed	Yields from tests in Maryland, as percentage of average yield from domestic seed	Yields from tests in Tennessee, as percentage of average yield from Tennessee anthracnose-resistant seed [1]	Yields from tests in Virginia, as percentage of average yield from domestic seed	Source of seed	Yields from tests in Maryland, as percentage of average yield from domestic seed	Yields from tests in Tennessee, as percentage of average yield from Tennessee anthracnose-resistant seed [1]	Yields from tests in Virginia, as percentage of average yield from domestic seed
Imported:				Domestic:			
Central Europe	102	85.5	79.5	Idaho	----------	----------	65
Chile	136	128.5	86	Maryland	114	----------	----------
Czechoslovakia				Minnesota	48	----------	----------
(Bohemia)	106	85	93	Ohio	128	108	119
England	----------	----------	74	Oregon	----------	----------	76
France	117	91	89.8	Tennessee	109	100	123
Hungary	106	108	110	Wisconsin	----------	----------	118
Italy	106	79	42.6				

[1] Wherever the Tennessee strain is mentioned in this report the selected anthracnose-resistant strain is meant.

The average yield of domestic clover expressed as 100 consists of the average yield from the domestic lots shown in each column. In the report for Maryland the yields from all domestic lots were averaged, including that from Minnesota, which was extremely low. If this is discarded the figure for French seed in Maryland becomes 100, and all other figures in the Maryland trials are reduced proportionately. At this station the French seed gave practically the same results in both first and second cuttings as the Maryland seed. All lots made a good second crop except the Minnesota, which made none.

At the Tennessee station only two lots, the Tennessee anthracnose-resistant and the Ohio, made any second growth whatever; all others died of anthracnose. The high rank of the Chilean is due to a remarkably heavy first crop. At the Virginia station only the Chilean 2217, among the imported lots, gave a second cutting approaching in quantity that from the Tennessee anthracnose-resistant seed.

RELATIVE YIELDS, 1923-24

Results of the trials of the experiment stations for the crop year 1923–24 are given in Tables 4, 5, and 6.

The winter of 1923–24 was extremely mild at Ames, Iowa, and consequently favorable to foreign clovers. Unfortunately, the seedings in Minnesota were killed by dry weather; and the New York experiment station issued no report for that year. Iowa, therefore, is the only State of the first group for which results are reported for 1923–24. (Table 4.)

TABLE 4.—*Relative yields from imported and domestic red-clover seed in Iowa, 1923–24*

Source of seed	Percentage of average yield from domestic seed	Source of seed	Percentage of average yield from domestic seed
Imported:		Domestic:	
Central Europe	94	Idaho	120
Chile	111	Iowa	103
Czechoslovakia (Bohemia)	97	Michigan	80
England	85	Mississippi	91
France	94.5	Ohio	105
Hungary	97	Oregon	90
Italy	92.7	Tennessee	123
Poland	94	Wisconsin	94
Riga	86		

TABLE 5.—*Relative yields from imported and domestic red-clover seed in Michigan, Ohio, and Wisconsin, 1923–24* [1]

Source of seed	Yields in tests in Michigan		Yields in tests in Ohio (North Ridgeville), as percentage of average yield from domestic seed	Yields in tests in Wisconsin			
				Madison			
	Percentage of average yield from domestic seed	Percentage of average yield from Michigan seed [2]		Percentage of average yield from domestic seed	Percentage of average yield from Wisconsin seed [3]	Ashland; percentage of average yield from domestic seed	Marshfield; percentage of average yield from domestic seed
Imported:							
Central Europe	96.0	84.0	92.0	110.0	106.0	106.0	105.0
Chile	119.5	105.5	89.5	109.5	105.5	106.5	104.0
Czechoslovakia (Bohemia)	99.5	88.0	88.0	114.5	111.0	102.0	99.0
England	108.6	95.6	85.3	98.0	94.7	71.0	101.0
France	103.5	91.2	80.7	90.5	87.3	104.3	102.5
Hungary	92.6	81.7	90.5	104.0	100.0	99.3	----------
Italy	84.6	74.6	50.6	66.0	63.8	69.0	92.8
Poland	93.0	82.0	----------	99.0	95.0	101.0	98.0
Riga	99.0	87.0	101.0	106.0	102.0	88.0	80.0
Domestic:							
Idaho	99.0	87.0	102.5	104.0	100.0	106.0	90.0
Michigan	114.0	101.0	105.0	106.0	102.0	104.0	95.0
Minnesota	89.0	78.0	96.0	79.0	77.0	97.0	118.0
Mississippi	100.0	88.0	----------	111.0	108.0	----------	----------
Ohio	102.0	90.0	108.5	98.0	94.0	105.0	96.0
Oregon	84.0	74.0	75.0	79.0	76.0	83.0	96.0
Tennessee	112.0	99.0	97.0	110.0	106.0	93.0	105.0
Wisconsin	100.0	88.0	103.0	106.5	102.5	101.0	100.0

[1] 2 cuttings were made at all stations except Ashland, Wis. [2] 44 checks. [3] 5 checks.

During this year again seed of several foreign origins gave relatively good yields in the second group of States; but the yield from Oregon seed was low in all but one case, and this relatively low yield forms a part of the total average yield from domestic seed expressed as 100. If the Oregon yield is left out of the average, the average yield from domestic seed will be higher, and consequently the relative figures for the seed of foreign origins lower.

TABLE 6.—*Relative yields from imported and domestic red-clover seed in Maryland and Virginia, 1923–24* [1]

Source of seed	Yields in tests in Maryland, as percentage of average yield from domestic seed	Yields in tests in Virginia, as percentage of average yield from domestic seed	Source of seed	Yields in tests in Maryland, as percentage of average yield from domestic seed	Yields in tests in Virginia, as percentage of average yield from domestic seed
Imported:			Domestic:		
Central Europe	67	65	Idaho	----------	77
Chile	77	85.5	Maryland	111	----------
Czechoslovakia (Bohemia)	67	63.5	Michigan	----------	101.5
England	----------	47.5	Minnesota	89	61
France	81	----------	Ohio	98	135
Hungary	81	41	Tennessee	102	138
Italy	83	18.8			
Poland	----------	32			
Riga	----------	51			

[1] Seedings in Tennessee failed because of dry weather. Two cuttings were made in Maryland and one in Virginia.

The recovery of the foreign clovers in 1924 at the stations in the third group of States was very poor. In Virginia only the Chilean made enough second growth to cut at all, while in Maryland the second cutting of the foreign lots yielded about one-third as much as the second cutting from the domestic lots.

RELATIVE YIELDS, 1924–25

Results of the trials at the experiment stations for the crop year 1924–25 are given in Tables 7, 8, and 9.

TABLE 7.—*Relative yields from imported and domestic red-clover seed in Iowa and New York, 1924–25*

Source of seed	Yields in tests in Iowa, as percentage of average yield from domestic seed	Yields in tests in New York, as percentage of average yield from Michigan seed [1]	Source of seed	Yields in tests in Iowa, as percentage of average yield from domestic seed	Yields in tests in New York, as percentage of average yield from Michigan seed [1]
Imported:			Domestic:		
Canada	102		Idaho	112.5	97
Central Europe	76		Iowa	121	
Chile	82.3	99	Michigan	98	
Czechoslovakia (Bohemia)	69		Minnesota	85	89
England	61.6	94	Ohio	116	100
France	65.4	95.3	Oregon	68	83
Germany	73.3		Wisconsin	119	
Hungary	68.5	97			
Italy	42.8	66			
Rumania	74				

[1] 6 nearest checks.

Two cuttings were made at each station in Iowa and New York. The average yield from domestic lots shown in Table 7 was put at 100, except that for New York the average yield from Michigan seed is placed at 100.

TABLE 8.—*Relative yields from imported and domestic red-clover seed in Michigan, Ohio, Pennsylvania, and Wisconsin, 1924–25*

Source of seed	Yields in tests in—				
	Michigan (East Lansing)		Ohio (North Ridgeville), as percentage of average yield from domestic seed	Pennsylvania, as percentage of average yield from domestic seed	Wisconsin (Spooner) as percentage of average yield from domestic seed
	Percentage of average yield from domestic seed	Percentage of average yield from Michigan seed [1]			
Imported:					
Canada	95.5	81.5	103.0	104.0	117.0
Central Europe	109.0	93.0	98.0		113.0
Chile	109.7	94.0	108.8	116.0	140.0
Czechoslovakia (Bohemia)	108.0	92.5	96.0		96.0
England	97.9	78.6	94.0	111.0	104.0
France	109.6	93.7	113.4	122.0	133.3
Germany	89.0	76.0	95.0	119.0	
Hungary	99.3	85.0	95.0	118.0	129.0
Italy	63.0	53.7	64.4	103.7	90.0
Poland			98.0		
Riga			78.0		
Rumania	98.5	84.5	109.5	115.0	115.0
Domestic:					
Idaho	98.0	84.0	113.0	102.0	113.0
Maryland	115.0	98.0	103.0		
Michigan	111.5	95.5	96.4	107.0	104.0
Minnesota	96.0	82.0	90.0		108.0
Ohio	123.5	105.5	101.5	106.0	
Oregon	75.7	65.0	88.0	92.5	85.0
Wisconsin	101.0	86.5	105.5		122.0

[1] 48 checks.

By comparing Tables 7 and 8 it will again be clear that while foreign clovers may often do very well in the group of States where the winters are less severe, similar results are not obtained in those States in which severe winters are experienced.

TABLE 9.—*Relative yields from imported and domestic red-clover seed in Virginia and Tennessee, 1924–25* [1]

Source of seed	Yields in tests at or in—			
	Arlington Experiment Farm, Rosslyn, Va.		Tennessee, as percentage of yield from Tennessee anthracnose-resistant seed	Virginia (Blacksburg), as percentage of average yield from domestic seed
	Percentage of average yield from domestic seed	Percentage of average yield from Tennessee anthracnose-resistant seed [2]		
Imported:				
Canada	96.5	87.0		
Central Europe	93.0	84.0		
Chile	97.8	88.0	51.0	108.0
Czechoslovakia	93.8	84.5		
Czechoslovakia (Bohemia)	85.5	77.0		
England	94.3	82.3		121.0
France	95.9	86.3	59.7	82.0
Hungary	93.3	84.0	25.0	55.0
Italy	75.0	67.0	59.0	49.0
Poland	92.7	83.5		
Rumania	96.5	86.5		
Domestic:				
Idaho	107.0	97.0		
Maryland			96.0	96.0
Michigan	102.0	92.0	71.0	138.0
Minnesota	92.0	83.0		
Ohio	101.0	90.0		92.0
Oregon	99.0	89.3	26.0	72.0
Tennessee [3]	112.0	100.0		
Wisconsin	101.0	91.0	68.0	

[1] 2 cuttings each were made at the Arlington Experiment Farm and at Blacksburg, Va., and 1 in Tennessee.
[2] 17 checks.
[3] Anthracnose resistant.

At the Arlington Experiment Farm (Rosslyn, Va.) and in Tennessee the Tennessee anthracnose-resistant strain was used as a check. The 100 taken as the standard for Arlington Experiment Farm is the average yield from all check plots, together with plots of the other domestic lots shown in Table 9. At Blacksburg, Va., the average yield from the domestic lots shown in Table 9, under Virginia, was taken as 100.

The season of 1924–25 was ideal for clover at the Arlington Experiment Farm, anthracnose not becoming serious until late in the season. In the first crop nearly all plots gave good returns, and the variations in the relative standing of the different lots are due more to the second crop than to the first. The Tennessee anthracnose-resistant clover not only gave a good second crop but a third apparently as good as the second. Owing to rainy weather this could not be weighed, but observations made after the second cutting showed a progressive deterioration of the stand on all plots except those seeded to the Tennessee anthracnose-resistant strain. This dying out of the plants was due to anthracnose and affected the other domestic clovers as well as the foreign clovers, though not always to the same degree.

There is much food for thought in a comparison of the two columns of Table 9 giving the record at the Arlington Experiment Farm for 1924–25. Owing to the fact that these plots were seeded in August instead of in the spring of 1924, the young clover entered the winter in healthy condition, and 1925 yields of nearly all lots were heavy. In the first harvest, many of the foreign clovers considerably outyielded the domestic; but the second cutting of the foreign lots was not nearly so heavy, anthracnose and leaf hoppers taking considerable toll. The clovers all escaped complete destruction, however; but the yields from the plots seeded to anthracnose-resistant seed were considerably better than those from plots seeded to Michigan, Ohio, Minnesota, or Oregon seed. This is brought out in Table 9, where, in the second column, the yields from the foreign clovers are compared with the yields from all domestic lots, including Tennessee anthracnose-resistant; and in the third column a similar comparison is made with the yields from the check plots seeded to Tennessee anthracnose-resistant seed. At the second cutting many foreign and domestic lots already showed signs of disease and for the most part made little third growth. The clover on the plots seeded to Tennessee anthracnose-resistant seed, however, made a third growth nearly as heavy as their second.

In Tennessee all clovers, except the disease-resistant strain and that from Maryland seed, were badly attacked by anthracnose. The plots harvested in 1925 were seeded in the spring of 1924. At this station repeated observation had shown severe destruction of all nonresistant plants when seeding is done in spring, but much less injury when seeding is done in August. At Blacksburg, Va., the clovers were seeded in August, and there was little disease in the first cutting. Anthracnose, however, appeared in the second crop and reduced the yields of some strains.

CONCLUSIONS FROM 1922–1925 TESTS

The conclusions drawn from the record presented above in Tables 1 to 9 were stated as follows in the preliminary report of 1926:

> (1) The American type of clover, including that grown in Canada, is more resistant to severe winters than any foreign clover so far tested; and where severe winter conditions prevail only domestic red clover seed should be used. (2) Where anthracnose is the dominant factor in the failure of red clover, seed of a disease-resistant strain should be used, if possible. The exact extent of the regions subject to this disease can not be given at present, but it is believed that all the territory south of Pennsylvania and the Ohio River is included, and possibly the southern portions of the States north of the Ohio. In this region, seed from southern Ohio has given good results more often than that from farther north; and some seed from the extreme northern and western portions of the United States and from Canada has produced plants as susceptible to anthracnose as plants grown from French or from Chilean seed. Further trials are needed before final conclusions in this matter can be reached, but the evidence so far obtained points to the desirability of using, in the region subject to anthracnose, seed produced in that region rather than where the disease is uncommon or absent. It has been urged that the farmers in the southern part of the clover belt should use "hardy northern-grown seed"; but while northern-grown clover may be hardy with respect to severe winters, it is not necessarily disease resistant; and where anthracnose prevails the emphasis should be placed on locally adapted seed rather than on hardy northern-grown seed.

TRIALS IN 1926–1929

Cooperative trials of red-clover seed were continued in the same way from 1926 to 1929; this series, having been carried on for eight years, was then discontinued. In tabulating the results the same method of expressing yields used in Tables 1 to 9 was employed.

Since the preparation of the 1926 report the seed-importation law has been amended to provide for staining imported seed. During 1925 to 1929, therefore, the seed laboratory of the Bureau of Plant Industry furnished the Division of Forage Crops and Diseases with samples of nearly all lots of red-clover seed imported, and many of these were tested at the Arlington Experiment Farm and in Ohio and Iowa. These lots are referred to in this report as "import" lots. The results are given in separate tables.

THE STANDARD FOR DOMESTIC SEED

The 100 taken as a standard in each case represents the yields from the domestic lots of seed at each station, as shown in Tables 10 to 13.

The relative performance of the various lots of domestic seed is not given, as such a discussion would make the present report too cumbersome. The purpose of this circular is to show what may be expected of red-clover seed of foreign origin. That seed of domestic origin varies in quality is conceded, and a study of domestic lots is now in progress.

TABLE 10.—*Domestic seed from different sources, yields from which make up the standard of 100 used at the stations indicated, 1925–26*

Source of seed	Station at which the seed was used						
	Indiana	Ohio	Pennsylvania	Tennessee	West Virginia	Wisconsin	
						Spooner	Marshfield
Idaho	x	-----	-----	-----	x	-----	x
Maryland	-----	-----	-----	x	-----	-----	-----
Michigan	x	x	x	x	x	x	x
Minnesota	x	-----	x	-----	-----	x	x
Ohio	x	x	x	-----	x	x	x
Oregon	x	x	x	x	x	x	x
Tennessee	x	x	-----	x	x	x	x
Virginia	-----	-----	-----	x	-----	-----	-----
Wisconsin	x	x	-----	-----	x	x	x

TABLE 11.—*Domestic seed from different sources, yields from which make up the standard of 100 used at the stations indicated, 1926–27*

Source of seed	Station at which the seed was used												
	Indiana	Kentucky	Maryland	Michigan	Minnesota	Missouri	Ohio	Pennsylvania	Virginia		West Virginia	Wisconsin	
									Arlington	Blacksburg		Marshfield	Spooner
Idaho	x	-----	-----	x	-----	x	-----	x	x	-----	x	x	x
Illinois	-----			-----	x	x	-----	-----	-----	-----	-----	-----	-----
Indiana	x	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Kentucky	-----	x	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Maryland	-----	x	x	-----	-----	-----	-----	x	x	-----	-----	-----	-----
Michigan	x	x	x	x	x	x	x	x	x	x	x	x	x
Minnesota	x	x	x	x	x	x	-----	x	x	-----	-----	x	x
Missouri	-----	-----	-----	-----	-----	x	-----	-----	-----	-----	-----	-----	-----
North Dakota	-----	-----	-----	-----	x	-----	-----	-----	-----	-----	-----	-----	-----
Ohio	x	x	x	x	x	x	x	x	x	x	x	x	x
Oregon	x	x	x	x	x	x	x	-----	x	x	x	-----	-----
South Dakota	-----	-----	-----	-----	x	-----	-----	-----	-----	-----	-----	x	x
Tennessee	-----	x	x	-----	x	x	x	x	x	x	x	-----	-----
Virginia	-----	x	-----	-----	x	-----	-----	-----	x	x	-----	-----	-----
Wisconsin	-----	-----	-----	-----	x	-----	-----	x	x	-----	x	x	-----

TABLE 12.—*Domestic seed from different sources, yields from which make up the standard of 100 used at the stations indicated, 1927–28*

Source of seed	Station at which the seed was used						
						Virginia	
	Indiana	Ohio, North Ridgeville	Maryland	Pennsylvania	West Virginia	Arlington	Blacksburg
Colorado	x	x		x		x	x
Idaho	x	x		x	x	x	x
Illinois		x	x	x		x	x
Indiana	x	x				x	x
Iowa						x	
Kentucky						x	
Maryland				x		x	
Michigan	x	x	x		x	x	x
Minnesota	x	x		x		x	
Missouri						x	
Ohio	x	x		x	x	x	x
Oregon	x	x	x	x	x	x	
Tennessee	x	x			x	x	
Utah	x						
Virginia						x	
Wisconsin	x	x			x	x	x

TABLE 13.—*Domestic seed from different sources, yields from which make up the standard of 100 used at the stations indicated, 1928–29*

Source of seed	Station at which the seed was used								
	Iowa	Michigan	New York	Indiana	Maryland	New Jersey	Ohio	West Virginia	Kentucky
Colorado	x	x	x	x		x	x		x
Idaho	x			x					x
Illinois	x								
Indiana	x			x					x
Iowa	x								x
Kansas	x								
Kentucky	x								
Maryland					x				
Michigan	x	x	x	x	x	x	x		x
Minnesota	x			x					x
Missouri	x								x
Montana	x								
Nebraska	x								
North Carolina	x								
North Dakota	x								
New York	x		x						
Ohio	x			x	x	x	x		x
Oregon	x			x					x
Tennessee	x			x	x	x		x	x
Utah	x								
Washington	x								x
Wisconsin	x			x					x

YIELDS FROM FRENCH SEED (EXCEPT IMPORT LOTS)

Relative yields from French seed (except import lots) are shown in Tables 14 to 17.

There are no reports from Iowa for 1927–28. This is because winter conditions that year were so severe that all foreign clovers were nearly a total loss. As most of the foreign clovers that year were import lots, the winterkilling data will be presented under the discussion of those lots. The winter of 1928–29, on the other hand, was very favorable for red clover, and the foreign clovers did fairly well. In 1927–28 in Kentucky, zero weather followed immediately after growing weather, and all foreign clovers, five of them French, were completely killed. Several lots from northern States suffered severely, while those from Ohio, Maryland, and Kentucky were least injured.

The trend of results is substantially like that in the earlier report. The relative yields in the group of States, where the winters are less severe and where anthracnose is not a controlling factor, are higher than in those States which suffer from severe cold or where disease is prevalent. (Table 15.) An exception is seen in the Indiana record, where the results with French seed were less satisfactory than in adjoining States. Higher yields in Wisconsin, when they occur, are commonly related to an abundant winter snow cover.

TABLE 14.—*Relative yields from French red-clover seed (except import lots) in Iowa, Michigan, Minnesota, and Wisconsin, 1925–26 to 1928–29*

Year	Lot No.	Yields in tests in Iowa	Yields in tests in Michigan	Yields in tests in Minnesota	Yields in tests in Wisconsin	
					Marshfield	Spooner
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	2414				54	37
	2504				96	44
	2509				85	53
1926–27	2533		[1] 69		87	
	2504		[1] 62		88	
	2584		[1] 68			
	2509		[1] 70	32	93	
	2634			21		
	2635			37		
	2636			21		
	2411			21		
	2594				103	
1928–29	14459	100				
	14483	67				
	14484	89				
	14495	104				
	14496	98				

[1] 1 cutting; all others, 2 cuttings.

TABLE 15.—*Relative yields from French red-clover seed (except import lots) in Indiana, Ohio, Maryland, Pennsylvania, and West Virginia, 1925–26 to 1928–29*

Year	Lot No.	Yields in tests in Indiana	Yields in tests in Ohio [1]	Yields in tests in Maryland	Yields in tests in Pennsylvania	Yields in tests in West Virginia
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	58472	81			90	
	58631	76				
	58632	76				
	59290	79			93	
	2411					77
	2414	41				
	2504		[2] 90			72
	2509		[2] 82			
1926–27	2533	43			91	
	2504	70	[2] 90		82	53
	2584	22	[2] 83	[2] 95	87	49
	2509	83			85	
1927–28	14136				83	
	14146			24	79	
	14156			33	84	
	2509	24	82			43
	2584	54				
	2633		63	33		
	2683	25	82			55
	2684		61			48
	2686		73			
	2687	39	74		90	
	2691		70			
	2692		82			
	66127	45				
1928–29	14459	68	91			
	14484	69				
	14496	72				
	15690		86	79		

[1] 1925–26 and 1926–27 reports from Wooster, others from North Ridgeville.
[2] 1 cutting; all others, 2 cuttings.

Table 16.—*Relative yields from French red-clover seed (except import lots) in Kentucky, Missouri, Tennessee, and Virginia, 1925–26 to 1928–29*

Year	Lot No.	Yields in tests in Kentucky	Yields in tests in Missouri	Yields in tests in Tennessee	Yields in tests in Virginia	
					Arlington	Blacksburg
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	58632			[1] 84		
1926–27	2533	82	64		[2] 61	
	2504	76			[2] 53	11
	2584	48	60		[2] 61	37
	2509		55		[2] 62	23
	2618		81			
1927–28	14136					89
	14146					33
	14156					29
	14153				[1] 2	
	2683				[1] 4	
	2692				[1] 37	
	2686				[1] 2	
1928–29	14459	[1] 73				
	14485	[1] 110				
	14496	[1] 77				

[1] 1 cutting; all others, 2 cuttings.

[2] Fall seedings yielded, respectively, 85, 85, 79, and 94 per cent.

A summary of the results from French seed (except import lots) is given in Table 17.

Table 17.—*Summary of results from tests with French red-clover seed (except import lots), 1925–26 to 1928–29 (Tables 14, 15, and 16), arranged in percentage groups*

Group of States and year	Number of cases in specified percentage group								
	0–19	20–39	40–59	60–79	80–89	90–99	100–109	110–119	Total number of cases
Iowa, Minnesota, Michigan, and Wisconsin:									
1925–26	0	1	3	0	1	1	0	0	6
1926–27	0	5	0	4	2	1	1	0	13
1927–28	0	0	0	0	0	0	0	0	0
1928–29	0	0	0	1	1	1	2	0	5
Indiana, Pennsylvania, Ohio, Maryland, and West Virginia:									
1925–26	0	0	1	5	2	3	0	0	11
1926–27	0	1	3	1	5	3	0	0	13
1927–28	0	6	5	6	5	1	0	0	23
1928–29	0	0	0	4	1	1	0	0	6
Kentucky, Missouri, Tennessee, and Virginia:									
1925–26	0	0	0	0	1	0	0	0	1
1926–27	1	2	3	6	2	0	0	0	14
1927–28	3	3	0	0	1	0	0	0	7
1928–29	0	0	0	2	0	0	0	1	3
Total	4	18	15	29	21	11	3	1	102
Per cent	3.92	17.65	14.71	28.43	20.59	10.78	2.94	.98	100

YIELDS FROM FOREIGN, OTHER THAN FRENCH, SEED

As shown by the record in Tables 18, 19, and 20, the yields from foreign clovers, other than French, tested during the four years covered by this report have not generally been so heavy as the average yield from domestic seed. For the group of States shown in Table 18, in 41 out of 65 cases, the yield was less than 90 per cent as large as the average from all domestic seed; in the group of States shown in Table 19, in 54 out of 71 cases, and in the group of States shown in Table 20, in 23 out of 26 cases, the yield was less than 90 per cent as large as the average yield from all domestic seed.

TABLE 18.—*Relative yields from foreign red-clover seed, other than French (except import lots), in Iowa, Michigan, Minnesota, New York, North Dakota, and Wisconsin, 1925–26 to 1928–29* [1]

Year	Source of seed	Lot No.	Yields in tests in Iowa	Yields in tests in Michigan	Yields in tests in Minnesota	Yields in tests in New York	Yields in tests in North Dakota	Yields in tests in Wisconsin	
								Marshfield	Spooner
			Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	Hungary	2413						73	98
	do	2518						100	94
	Rumania	2423						77	124
	Canada	2404						108	87
	do	2409						88	60
1926–27	Poland	2543		[1] 92	87			116	[1] 89
	do	2544		[1] 98	89			102	[1] 85
	do	65965			94				
	do	58858			76				
	do	61354			55				
	Germany (Silesia)	2514		[1] 84	73			91	[1] 93
	Hungary	2413		[1] 89	56			91	[1] 87
	do	2415			45				
	do	2518						63	[1] 91
	do	2508			57				
	Rumania	2423			74				
	do	2516			65			102	[1] 80
	Canada	2647		[1] 81				88	[1] 91
	Czechoslovakia	61381			64				
	do	61383			59				
1928–29	Poland	15517		99		86	[1] 58		
	do	15518		100			[1] 69		
	do	15695					[1] 71		
	do	15696		105		86			
	do	76414					[1] 71		
	do	76415					[1] 67		
	Hungary	14478	107						
	Rumania	15659	107						
	Russia (Kursk)	15525		99		83	[1] 64		
	do	15633					[1] 86		
	Russia (Ukraine)	15703		91		64	[1] 57		
	do	15710		98		87	[1] 79		
	Latvia	14491	70						

[1] 1 cutting; all others, 2 cuttings.

NOTE.—The winter of 1927-28 was very hard on clover, and most plantings for that year failed entirely.

TABLE 19.—*Relative yields from foreign red-clover seed, other than French (except import lots), in Indiana, Maryland, New Jersey, Ohio, Pennsylvania, and West Virginia, 1925–26 to 1928–29*

Year	Source of seed	Lot No.	Yields in tests in Indiana	Yields in tests in Maryland	Yields in tests in New Jersey	Yields in tests in Ohio [1]	Yields in tests in Pennsylvania	Yields in tests in West Virginia
			Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	Czechoslovakia	61379					53	
	do	61381					57	
	do	61382					84	
	Hungary	2518				[2] 110		
	do	2415	70				64	
	do	2413	78					48
	do	59299					82	
	do	59300	58					
	Canada	2409	76				118	
	do	2404	107					
	do		95					
	Rumania	2423	60			[2] 100	57	49
	do	58514					54	

[1] 1925–26 and 1926–27 reports from Wooster; others from North Ridgeville.
[2] 1 cutting; all others, 2 cuttings.

TABLE 19.—*Relative yields from foreign red-clover seed, other than French (except import lots), in Indiana, Maryland, New Jersey, Ohio, Pennsylvania, and West Virginia, 1925–26 to 1928–29*—Continued

Year	Source of seed	Lot No.	Yields in tests in Indiana	Yields in tests in Maryland	Yields in tests in New Jersey	Yields in tests in Ohio [1]	Yields in tests in Pennsylvania	Yields in tests in West Virginia
			Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1925–26	Poland	58856	52					
	do	58857	53					
	do	61335	57					
1926–27	Rumania	2423		[2] 57		[2] 88		52
	do	2516	57				98	
	Germany (Silesia)	2514	45					
	Poland	2543	36			[2] 80	92	
	do	2544					97	
	do	65965					78	
	Hungary	2413	35				80	51
	do	2518				[2] 120		
	do	2508					90	
	Canada		90					
	do		109					
	do		82					
1927–28	Poland	2543				89		
	do	65965				91		
	Russia	66790				50		
	do	66793				73		
	do	67172				46		
	do	72589				27		
	Hungary	2667	27	103				60
	Rumania	2661	48	38				60
	Canada	2647	75					
1928–29	Poland	15517			[3] 35	65		
	do	15518				90		
	Russia (Kursk)	15525		64				
	Russia (Ukraine)	15703	61	[2] 55	[3] 34	74		86
	do	15710	12	79				
	Hungary	15691				93		
	do	14478	72		[3] 41			
	Rumania	15659	57	[2] 76		97		

[1] 1925–26 and 1926–27 from Wooster; others from North Ridgeville.
[2] 1 cutting; all others, 2 cuttings.
[3] Fall seedings yielded, respectively, 79, 46, and 94 per cent.

TABLE 20.—*Relative yields from foreign red-clover seed, other than French (except import lots), in Kentucky, Missouri, Tennessee, and Virginia, 1925–26 to 1928–29*

Year	Source of seed	Lot No.	Yields in tests in Kentucky	Yields in tests in Missouri	Yields in tests in Tennessee	Yields in tests in Virginia (Arlington)
			Per cent	*Per cent*	*Per cent*	*Per cent*
1925–26	Hungary	2413			[1] 87	
	do	2518			[1] 46	
1926–27	Poland	2543		71		
	do	2544		59		
	Germany (Silesia)	2514		64		[2] 56
	Hungary	2413	40	55	[2] 63	19
	do	2518		65	[2] 65	
	do	2415		60	[2] 58	
	do	2508	37			
	Rumania	2423	63			
	do	2516	65		[2] 63	149
	Canada	2646			[2] 91	
1927-28	Russia	14157			52	
	Germany (Silesia)	2514			[2] 56	
1928–29	Poland	15518	[1] 24			
	Hungary	14478	[1] 79			
	Rumania	15659	[1] 92			
	Canada	14480	[1] 65			

[1] 1 cutting; all others, 2 cuttings.
[2] Fall seedings of Silesian seed yielded 83 per cent in 1927 and 83 per cent in 1928; Hungarian yielded 88, 80, and 89 per cent, respectively; Rumanian 82 per cent, and Canadian 85 per cent in 1927.

Table 21 summarizes Tables 18, 19, and 20 into percentage groups.

TABLE 21.—*Summary of results from tests with foreign red-clover seed, other than French (except import lots), 1925–26 to 1928–29 (Tables 18, 19, and 20), arranged in percentage groups*

Group of States and year	Number of cases in specified percentage group											Total number of cases
	0–19	20–39	40–59	60–79	80–89	90–99	100–109	110–119	120–129	130–139	140–149	
Iowa, New York, Michigan, North Dakota, Minnesota, Wisconsin:												
1925–26	0	0	0	3	2	2	2	0	1	0	0	10
1926–27	0	0	5	6	10	8	2	1	0	0	0	32
1927–28	0	0	0	0	0	0	0	0	0	0	0	0
1928–29	0	0	2	8	5	4	4	0	0	0	0	23
Indiana, Ohio, Maryland, Pennsylvania, New Jersey, West Virginia:												
1925–26	0	0	10	5	2	1	2	2	0	0	0	22
1926–27	0	2	5	1	4	5	1	0	1	0	0	19
1927–28	0	3	3	4	1	1	1	0	0	0	0	13
1928–29	1	2	3	7	1	3	0	0	0	0	0	17
Kentucky, Missouri, Tennessee, Virginia:												
1925–26	0	0	1	0	1	0	0	0	0	0	0	2
1926–27	1	1	5	9	0	1	0	0	0	0	1	18
1927–28	0	0	2	0	0	0	0	0	0	0	0	2
1928–29	0	1	0	2	0	1	0	0	0	0	0	4
Total	2	9	36	45	26	26	12	3	2	0	1	162
Per cent	1.23	5.56	22.22	27.78	16.05	16.05	7.41	1.85	1.23	0	.62	100

FOREIGN COMPARED WITH OHIO SEED

Reference has been made to the fact that the foreign clovers show a higher relative yield when compared with the average of all American lots than when compared with some one good American stock. Table 22 illustrates this point. The data given are merely for the purpose of showing that even in a favorable clover year like 1928–29, when the foreign clovers did relatively well, their performance was less satisfactory when compared with the better yielding domestic strain. The record from Kentucky is especially interesting. The high relative yield of French No. 14485, when the average of all American lots is taken as 100, shows not so much a high yield of French at Lexington that year as that several domestic lots were unsatisfactory. When the French seed is compared with Ohio seed only, the yield of the French seed is found to be only 55 per cent of that from Ohio seed.

TABLE 22.—*Comparison of yields of foreign red clovers with the average of all domestic lots and with a single superior domestic strain (Ohio), 1928–29*

Country of origin and lot No.	Yields in tests in Indiana		Yields in tests in Kentucky		Yields in tests in New Jersey		Yields in tests in Ohio	
	All domestic yields as 100	Ohio yield as 100	All domestic yields as 100	Ohio yield as 100	All domestic yields as 100	Ohio yield as 100	All domestic yields as 100	Ohio yield as 100
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
France:								
14459	68	59	[1] 73	[1] 36	--------	--------	91	86
14484	69	61	--------	--------	--------	--------	--------	--------
14485	--------	--------	[1] 110	[1] 55	--------	--------	--------	--------
14496	72	63	[1] 77	[1] 38	[2] 33	[2] 41	--------	--------
15690	--------	--------	--------	--------	--------	--------	86	81
Hungary:								
14478	72	63	[1] 79	[1] 39	[2] 41	[2] 44	--------	--------
15691	--------	--------	--------	--------	--------	--------	93	87

[1] 1 cutting; others, 2 cuttings.

[2] Fall seedings of French yielded 86 per cent of the domestic and 82 per cent of the Ohio; Hungarian, 94 per cent of domestic and 92 per cent of Ohio. After a severe winter, as in 1927–28, the difference is greater.

The results of tests of French and other foreign seed and of Ohio seed, as compared with the yield from all domestic lots, for the years 1925–26 to 1928–29, are shown graphically in Figure 1. The curves for French and for other foreign seed are much alike, while the curve for Ohio seed shows that seed from this source has given results better than the average from all American seed.

SECOND CUTTING

The second cutting from foreign seed is commonly poor. It was pointed out in the report of 1926 that, while the imported clovers often produce a good hay crop on first cutting, the second growth is likely to be poor or wanting. The fact that the second cutting is relatively poorer than the first is brought out in Table 23. The cases in which only one cutting was made were nearly always due to this failure of the foreign clovers to make a recovery. In 1925–26 (Table 15) the recovery of almost all foreign clovers in Indiana was meager to moderate; sometimes no recovery was made. On the plots seeded to Indiana, Minnesota, Ohio, and Tennessee seed, however, the second growth was thrifty to very thrifty. In 1927–28 at the same station the foreign clovers produced no second growth but died almost immediately after cutting. At the same station in 1928–29 all foreign clovers again made poor recovery. The same was true at Wooster, Ohio, in 1926–27, when no second cutting was taken because the growth on all foreign clovers was poor and yellow, whereas, the growth on plots seeded to domestic seed was good. The same year the West Virginia station noted that the second growth of all foreign clovers was short and severely diseased, while that on domestic-seed lots was good. In Kentucky in 1928–29 only one cutting was taken, as there was no recovery of any foreign lot. Exceptions occur to the rule that the second cutting fails, but it is rare for the French, or any other imported lot, to give a relatively better second cutting than first.

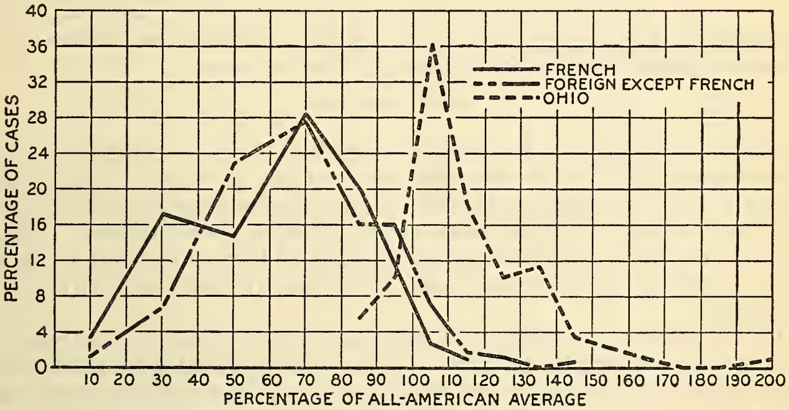

FIGURE 1.—Relative yields from French and other foreign (except imports) and Ohio red-clover seed, as compared with the yield from all domestic lots for the years 1925–26 to 1928–29

TABLE 23.—*Relative yields from certain lots of French red clover, first and second crops separately, compared with three standard lots of domestic origin*[1]

Year	Lot No.	Yields in tests in Ohio		Yields in tests in Pennsylvania		Yields in tests in Iowa		Yields in tests in Indiana	
		First crop	Second crop	First crop	Second crop	First crop	Second crop	First crop	Second crop
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1927–28	22612	[2] 105.5	69						
	22700	106	57						
	2687			72	37				
	14136			72	21.5				
	14146			76	29				
	14156			76	21.5				
1928–29	14459					107	77	81	38
	14484					97	72	82	41
	14496					108	81	89	33
	24552					99	75		
	23475					106	53		
	23424					97	80		

[1] In Ohio, Indiana, and Iowa the domestic lots used were from Ohio, Michigan, and Tennessee; in Pennsylvania the domestic lots were from Ohio, Illinois, and Idaho.

[2] Figures are given to the nearest whole number except when the fraction is 0.5.

WEED CONTENT

Observation in the field brings out the fact that the imported clovers often begin to die soon after the first cutting is made. Part of this dying is due to disease and part to leaf-hopper damage, but usually it is not possible to determine exactly the factors involved. When the clover dies out, weeds come in; and at harvest time it is necessary to take account of weed content either by estimate or by actual weighing.

It has not been possible in all cases to deduct the weed content, but had it been possible in all cases to do so the figures for relative yields from imported red-clover seed would be lower than those shown in the tables.

This point is illustrated in Table 24, in which a few instances are given of the effect of weed content on the yields of hay at Ames, Iowa, in 1928–29. At this station the estimated weed content in the second crop on plots seeded to French red clover varied from a trace to 70 per cent of the total weight of hay. The table shows the yield of two cuttings of French clover relative to the Iowa checks, both with and without deduction for weeds.

TABLE 24.—*Yields from French red-clover seed, with and without deduction for weeds in second crop, compared with yield from Iowa seed at Ames, Iowa, in 1928–29*

Lot No	Relative yield without deduction for weeds	Estimated weeds in second crop, 3 plots	Net yield after deduction for weeds
	Per cent	*Per cent*	*Per cent*
23626	91	15, 55, 50	69
23440	100	20, 25, 35	83
24460	92	15, 40, 55	71
23596	114	20, 45, 55	85
23166	96	25, 50, 40	85
24480	96	15, 25, 55	77

YIELDS FROM IMPORT LOTS

Since the amendment to the seed importation act requiring the staining of red-clover seed, samples have been drawn by the seed laboratory of the Bureau of Plant Industry for study as to country of origin. These samples later have been turned over to the Division of Forage Crops and Diseases for field study, and as many as possible have been included in field trials. Successful stands and yield records were obtained in 1925–26 at the Arlington Experiment Farm, Rosslyn, Va., in 1926–27 at North Ridgeville, Ohio, and in 1928–29 at Ames, Iowa. The domestic lots with which these import lots were compared are shown in Table 25. The relative yields from the lots tested are shown in Tables 26, 27, and 28.

Table 25.—*Domestic red-clover seed from different sources, yields from which make up the standard of 100 used as basis for percentage yields of import lots of seed*

Source of seed	Station at which seed was used			
	Ames, Iowa, 1928–29	North Ridgeville, Ohio, 1927–28	Arlington Experiment Farm, Rosslyn, Va.	
			1925–26	1927–28
Colorado	x			
Idaho	x	x		
Illinois	x	x		
Indiana	x	x		
Iowa	x			
Kansas	x			
Kentucky	x			
Maryland			x	
Michigan	x		x	
Minnesota	x		x	x
Missouri	x			
Montana	x			
Nebraska	x			
New York	x			
North Carolina	x			
North Dakota	x			
Ohio	x		x	x
Oregon	x	x		
Tennessee	x		x	
Utah	x			
Virginia			x	x
Washington	x			
Wisconsin	x	x		

Table 26 summarizes in percentage groups the results from the tests at Arlington Experiment Farm, Rosslyn, Va.

TABLE 26.—*Summary of results from tests with import lots of red-clover seed at Arlington Experiment Farm, Rosslyn, Va., 1925–26 and 1927–28, arranged in percentage groups*

Year of test and source of seed	Number of cases in specified percentage group											Total number of cases
	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90–99	100–109	
1925–26:												
France	0	0	0	1	1	3	6	1	4	3	3	22
France (mixed?)	0	0	0	1	1	2	1	1	0	2	0	8
Canada	0	0	0	0	0	1	0	0	1	3	1	6
Central Europe	0	0	0	0	1	1	1	0	0	0	0	3
1927–28:												
France	2	2	3	3	1	0	0	1	0	2	0	14
France (mixed?)	4	1	0	3	1	0	0	0	0	0	1	10
Mixed	2	4	2	0	0	0	1	0	1	0	1	11
Possibly mixed	0	0	1	1	0	0	2	1	1	0	0	6
Uncertain	2	1	0	0	0	1	0	0	0	0	0	4
Total	10	8	6	9	5	8	11	4	7	10	6	84
Per cent	11.91	9.52	7.14	10.71	5.95	9.52	13.10	4.76	8.34	11.91	7.14	100

An important feature of the trials at Arlington Experiment Farm was the recovery of various lots after cutting in June. During 1925–26 the recovery of plants from French seed, from seed of mixed origin, and from seed from central Europe was mainly poor to very poor; a few lots made a fair recovery. Plants from Canadian seed made a fair to good recovery, while all lots from domestic seed made a good to very good recovery. In 1926–27 there was no recovery of any plants of foreign origin. The plants died after cutting. Plants from domestic seed made a good recovery.

Table 27 gives the number of cases falling into the various percentage groups resulting from the tests at North Ridgeville, Ohio.

TABLE 27.—*Summary of results from tests with import lots of red-clover seed at North Ridgeville, Ohio, 1927–28, arranged in percentage groups*

Crop and source of seed	Number of cases in specified percentage group								Total number of cases
	40–49	50–59	60–69	70–79	80–89	90–99	100–109	110–119	
First crop:									
France	0	0	0	0	1	3	6	3	13
France-Italy	0	0	0	9	7	3	0	0	19
Russia	0	0	0	0	1	1	0	0	2
Mixed	0	0	5	4	2	1	2	2	16
Total	0	0	5	13	11	8	8	5	50
Per cent	0	0	10	26	22	16	16	10	100
Second crop:									
France	1	5	6	1	0	0	0	0	13
France-Italy	3	9	2	4	1	0	0	0	19
Russia	0	0	0	2	0	0	0	0	2
Mixed	1	5	6	2	1	1	0	0	16
Total	5	19	14	9	2	1	0	0	50
Per cent	10	38	28	18	4	2	0	0	100
Both crops:									
France	0	0	0	2	4	7	0	0	13
France-Italy	0	0	5	9	5	0	0	0	19
Russia	0	0	0	1	1	0	0	0	2
Mixed	0	0	6	4	3	2	1	0	16
Total	0	0	11	16	13	9	1	0	50
Per cent	0	0	22	32	26	18	2	0	100

The results of the tests of import lots of red-clover seed at North Ridgeville, Ohio, in 1927–28 are shown graphically in Figure 2.

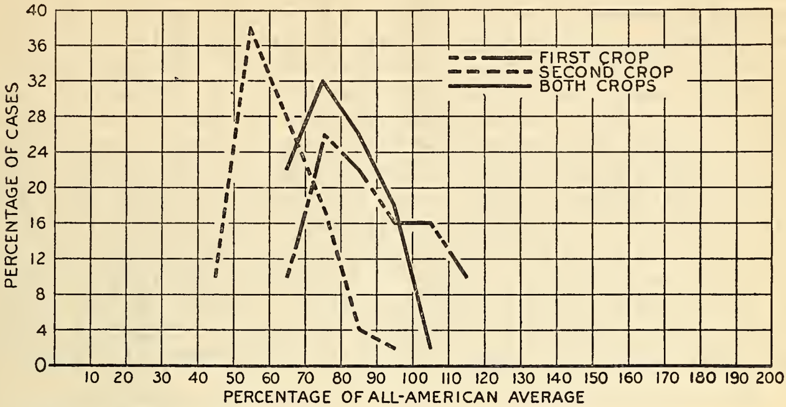

FIGURE 2.—Relative yields from imported red-clover seed at North Ridgeville, Ohio, in 1927–28, as compared with the yield from all domestic lots

A summary of the results from tests at Ames, Iowa, falling into the various percentage groups is given in Table 28.

TABLE 28.—*Summary of results from tests with import lots of red-clover seed at Ames, Iowa, 1928–29, arranged in percentage groups*

Crop and source of seed	Number of cases in specified percentage group								Total number of cases
	40–49	50–59	60–69	70–79	80–89	90–99	100–109	110–119	
First crop:									
France	0	0	0	0	0	7	8	4	19
Poland	0	0	0	1	5	7	5	1	19
Russia	0	0	0	0	7	5	2	0	14
France-Italy	0	0	0	0	1	1	1	1	4
Rumania	0	0	0	0	0	1	1	0	2
Hungary	0	0	0	0	0	0	2	0	2
Canada	0	0	0	0	0	0	1	1	2
Total	0	0	0	1	13	21	20	7	62
Per cent	0	0	0	1.61	20.97	33.87	32.26	11.29	100
Second crop:									
France	1	3	1	6	4	3	1	0	19
Poland	0	4	11	3	0	0	0	1	19
Russia	1	3	5	3	2	0	0	0	14
France-Italy	0	0	2	2	0	0	0	0	4
Rumania	0	0	0	0	1	0	1	0	2
Hungary	0	0	1	0	1	0	0	0	2
Canada	0	0	1	1	0	0	0	0	2
Total	2	10	21	15	8	3	2	1	62
Per cent	3.23	16.13	33.87	24.19	12.90	4.84	3.23	1.61	100
Both crops:									
France	0	0	0	2	6	9	2	0	19
Poland	0	1	3	4	7	3	1	0	19
Russia	0	0	1	6	6	1	0	0	14
France-Italy	0	0	0	1	1	2	0	0	4
Rumania	0	0	0	0	0	2	0	0	2
Hungary	0	0	0	0	1	1	0	0	2
Canada	0	0	0	0	0	2	0	0	2
Total	0	1	4	13	21	20	3	0	62
Per cent	0	1.61	6.45	20.97	33.87	32.26	4.84	0	100

The results of the tests of import lots of red-clover seed at Ames, Iowa, in 1928–29 are shown graphically in Figure 3.

It will be evident from a study of Tables 26, 27, and 28 that these imported clovers only rarely have given yields comparable with those from domestic seed even when all domestic lots—good, bad, and fair—are averaged and the average yield placed at 100. The fact that the record for foreign red clover would be lower, if comparisons were made with the better domestic lots, has been brought out in Table 22.

Of the import lots harvested at the Arlington Experiment Farm in 1925–26 and 1927–28, 71 per cent yielded less than 75 per cent of the average from domestic seed, 19 per cent yielded between 75 and 95 per cent, inclusive, and 10 per cent yielded 96 to 100 per cent or more. Since only one cutting was made that year at the Arlington Experiment Farm, attention is called to the statements regarding the recovery of the plants tested there (page 20). Nearly all the foreign clovers made so poor a recovery and suffered so much from disease that weeds made the larger portion of the growth and a second cutting was not taken. The American lots from Tennessee, Ohio, Maryland, Virginia, Michigan, and Minnesota, with scarcely an exception, made an excellent recovery, showed little or no anthracnose damage, and would have given a good second cutting.

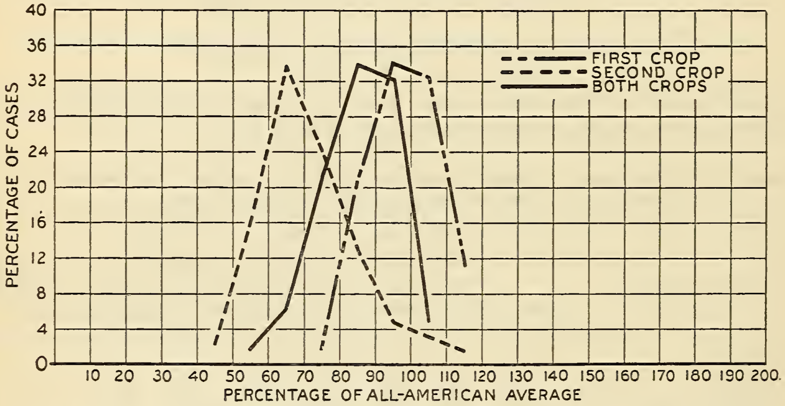

FIGURE 3.—Relative yields from imported red-clover seed at Ames, Iowa, in 1928–29, as compared with the yield from all domestic lots

With two exceptions out of 50 lots tested the second crop was relatively poorer than the first. (Table 27.) With three exceptions out of 62 lots tested at Ames, Iowa, the second crop was relatively poorer than the first. (Table 28.) This was a good clover year at Ames.

Of the import lots harvested at North Ridgeville, Ohio, in 1927–28, 48 per cent yielded less than 75 per cent as well as the average from domestic seed; 48 per cent yielded from 75 to 95 per cent as well; and only 4 per cent yielded between 96 and 100 per cent or more.

Owing to favorable winter and spring conditions at Ames, Iowa, in 1928–29, the average yield from import seed was fair, but even so only 16 per cent yielded 95 per cent as well as or better than the average from domestic seed. At Ames in 1928–29, the French lots averaged better than other import lots, but even so only 1 lot out of

19 gave a relative yield as high as 90 per cent of the Iowa checks, while nearly 50 per cent of the French lots fell below 80 per cent of the Iowa checks. When compared with Ohio seed in Iowa, 10.5 per cent of the French import lots exceeded the Ohio seed, 47 per cent yielded between 86 and 100 per cent as well, while 42 per cent yielded less than 86 per cent as well as Ohio seed.

WINTERKILLING

The winter of 1927–28 was very hard on red clover at Ames, Iowa, and in consequence no yield records are available. Stand and winterkilling data were taken, however, and these have value in showing that under severe winter conditions the imported red clovers do not survive so well as the better domestic lots. (Table 29.) All French lots as well as the mixed and possibly mixed lots were for all practical purposes completely winterkilled. While this record is from Ames, Iowa, similar observations have been made at other stations; and the conclusion is inescapable that wherever winter conditions are likely to be severe, most of the imported red clovers will suffer more than the better domestic lots.

TABLE 29.—*Average winterkilling of red clover from different sources at Ames Iowa 1927–28* [1]

Source of seed [2]	Plots	Winterkilling	Source of seed [2]	Plots	Winterkilling
	Number	*Per cent*		*Number*	*Per cent*
France	59	94. 1	Russia	24	25. 5
France-Italy	49	93. 4	Mixed	25	95. 8
Italy	11	99. 3	Possibly mixed	26	91. 8
Poland [3]	3	8. 3	Iowa (check)	61	12. 1

[1] From data tabulated by L. Dunn.

[2] Sources of foreign seed according to Seed Laboratory, Bureau of Plant Industry.

[3] There was only one Polish lot.

Attention is called to the fact that low temperatures alone do not necessarily make for severe winter conditions. The heavy snow cover commonly experienced in some sections amply protects the clover, and in such places the imported lots survive the winter and yield at least a good first cutting.

SUMMARY

This report covers in condensed form the cooperative work in testing imported red-clover seed from various sources in the years 1922 to 1925, and in greater detail the work done from 1925–26 to 1928–29. In the second part of the report results are given for a total of 480 trials, in which were included seed from all countries from which any considerable importation may be expected. The trials were conducted at 21 stations in 16 States.

The foreign clovers, with few exceptions, have proved unsatisfactory for use in the eastern United States. Instances are recorded in which foreign clovers have outyielded the domestic clovers, but such cases commonly depend on unusually favorable conditions, such as mild winters or abundant snow cover.

The foreign clovers, when they pass the winters successfully, may give a fair to good first cutting, but the second crop is nearly always inferior and is often so poor as not to warrant cutting. The foreign clovers often die out immediately after the first cutting.

All domestic red-clover seeds are not of equal quality. Since yields from the poor-quality seed were included when the figure of 100 for domestic seed yields was set up, yields from foreign seed appear to be somewhat higher than they would have been if compared only with yields from the best-quality domestic seed.

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